

Male Behavior in *Euparagia richardsi* Bohart (Hymenoptera: Vespidae)

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The vespid subfamily Euparagiinae is considered to be the primitive sister-group of the rest of the Vespidae (Carpenter, 1981). Little information is currently available on nesting behavior in this rare group, the only two published reports, both on *E. scutellaris*, indicating that females construct turret-surmounted ground burrows with one or more cells, and provide their young with larvae of curculionid beetles. Females nest, at most, in small aggregations (Williams, 1927; Clement and Grissell, 1968).

No information is available about the behavior of males in Euparagiinae. Males of many aculeate Hymenoptera search for females at resources where females are concentrated, away from the nesting site (Thornhill and Alcock, 1983). This is likely to occur only when nests are scattered or occur in small aggregations, and where some resource is sufficiently rare and patchily distributed to result in a concentration of females at that resource site.

During a study of male behavior in *Stenodynerus taos* (Vespidae: Eumeninae), males and females of *E. richardsi* were frequently observed. Since there are no published reports on male behavior in Euparagiinae, the following observations will be useful in comparative studies of mating behavior in the Vespidae.

MATERIALS AND METHODS

Observations were made in Lower Sonoran Desert in the San Simon Valley, approximately 3 km west of Rodeo, New Mexico. The study site was a filled, unused concrete cattle trough, surrounded by scattered vegetation, especially *Sal-sola* sp., on bare soil. The water surface of the trough measured 3.4 × 0.7 m. Additional natural water sources were temporarily available after rains, and in 1981 an artificial pool 1 m in diameter was constructed approximately 10 m from the trough.

A variety of insects visit water sources in the area, usually females to obtain water, but males of some species are present as well. During the longer study on *S. taos* in 1980 and 1981, males and females of *E. richardsi* were observed at the trough and artificial pool. In 1981, males were observed between 22 July and 25 August and females between 3 August and 9 September. Some males were marked with individually distinctive dots of enamel paint on the thorax. Times are given in Mountain Standard Time.

RESULTS AND DISCUSSION

Females landed on the water surface presumably to obtain liquid for nest construction and excavation. An individual female would land on the most central

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portion of the trough, away from the concrete edges. Males similarly restricted flights to the central portion of the water, flying continuously back and forth down the central strip, rarely venturing toward the edges, where males of *S. taos* defended territories (Longair, 1984). Usually only a single male patrolled the central strip of the trough, with occasional incursions by a second male. At the pool, two males occasionally patrolled, without displacing one another. Males were sometimes chased by males of *S. taos*. On one occasion in 1981, when a male *E. richardsi* was taken from the trough in the morning for identification, a second male appeared within an hour and began to patrol. One marked male was present at the trough over a period of seven days, including one visit late in the day to the artificial pool. Between 16 August and 25 August, at least one male was present on the pool every day of observation.

On four occasions (three on 4 August and one on 5 August), males were observed to approach a female floating on the water surface. In three cases, when the male contacted the female, the female bent her abdomen forward under her thorax, and became completely passive, floating on her side on the water. Males antennated the female and tried to make genitalic contact, but in all cases, no successful copulation was observed and males released the female and resumed patrolling or left the trough, returning later. In one case, a male attempted to mount a single female twice in succession, with the same negative result. One female did not bend her abdomen on contact, but again the male released her without copulating.

In single-mating species, males are predicted to search for females in locations where access to virgin females is highest, that is where females are most concentrated. If nests are rare and widely scattered, searching for females at nest sites is likely to be relatively unproductive with respect to matings. In such cases, where females are more concentrated at some other resource, males may search there.

Females of *E. richardsi* come to water sources, probably to obtain water for use in nest construction, softening the soil for removal and manipulation, as is the case for many solitary vespids. Where water is scarce, this results in a concentration of females at such water sources. Males may encounter larger numbers of females at such sites and these observations indicate that males patrol portions of water and attempt to mate with females there. Since both virgin and mated females must come to water, this may explain the failed copulation attempts observed here.

Both males and females restrict their activity to the central portion of the water. This may be a result of the presence of territorial males of *S. taos* along the edges of the trough, but not in the central portion (Longair, 1984). Additional water sources such as temporary rain puddles and an artificial pool, result in more males patrolling. While no aggression between males was observed, the presence of only one or two males on a given water source suggests that displacement or avoidance of other males may occur.

The behavior of males of *E. richardsi* is somewhat similar to that of some other solitary vespids, the females of which obtain water for nest construction (Smith and Alcock, 1980; Longair, 1984), and hints strongly at the role of ecological factors, especially soil type for nesting, and availability of other resources, in determining the nature of mating systems in these wasps.

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